REMARKS

In the Office Action of June 6, 2003, Claims 12 - 18 were rejected. No claim was allowed. In response, Claim 12 is amended. Reexamination and reconsideration are respectfully requested in view of the foregoing amendments and the following remarks.

Rejection of Claim 12 - 14 and 16 - 18 under 35 U.S.C. §103(a) over Collins in view of Schneider

Claims 12 - 14 and 16 - 18 were rejected under 35 USC 103(a) as obvious over Collins (U.S. Patent No. 5,556,501) in view of Schneider et al (U.S. Patent No. 6,308,654). The Examiner alleges that Collins et al teach a plasma processing apparatus comprising a vacuum chamber upper plasma generating portion, a coil antenna for generating a plasma, a radio-frequency power source and matching network for supplying radio-frequency electric power to the antenna, a Faraday shield comprising surfaces disposed around the walls of the cylindrical source in order to ensure plasma uniformity by reducing capacitive coupling, a gas supply unit connected to a gas distribution ring for supplying a gas into the chamber, a wafer support for supporting a wafer, and a vacuum pumping system connected to a vacuum line disposed at the bottom of the chamber. The Examiner acknowledges that Collins does not teach that the plasma generation chamber has a trapezoidal form in a cross section and that the Faraday shield is in a floating position to a ground. The Examiner alleges that Schneider teaches a plasma reactor including a plasma generation chamber having a conical dome extending from the side of the lower chamber to a position approximately over the edge of the pedestal, that the

conical dome is arranged to have a larger rim at its bottom side towards the wafer processing area and a smaller rim at its top side away from the wafer processing area, and that the conical configuration of the wall assures good thermal contact and eliminates the air gaps present in prior art design. The Examiner further alleges that the use of conical wall shape together with conically shaped induction coil windings reduces the variation in the electric field in the chamber while the use of fixed and variable pitch coil windings can fine tune the effect of the desired electric field and that Schneider et al further teach a Faraday shield clement 272 that can be grounded or left floating so that no ohmic voltage drop occurs in it while it is acting as a Faraday shield. The Examiner takes the position that it would have been obvious to implement the conical configuration as taught by Schneider et al in the apparatus of Collins et al in order to reduce the variation in the electric field in the chamber particularly at the center of the chamber and that it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the Faraday shield connection mechanism as taught by Schneider et al in the apparatus of Collins et al in order to be able to leave the Faraday shield grounded or floating so that no ohmic voltage drop occurs in the shield when an RF is applied to the plasma generating inductive coil. Regarding claims 13, 14, 16, the Examiner further alleges that the apparatus of Collins et al further includes a third electrode disposed in the upper section, that the third electrode may be floating, grounded or connected to an RF power source, and that the third electrode may have various configurations and can be made of various material such as aluminum or silicon. Regarding claims 17, 18, the Examiner refers to in re Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984)

wherein it was held that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device is not patentably distinct from the prior art device.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested in Collins. Accordingly, it is respectfully submitted that the Claims 12 - 14 and 16 - 18 would not have been obvious over Collins.

Rejection of Claim 15 under 35 U.S.C. §103(a) over Collins in view of Schneider and further in view of Gorin

Claim 15 was rejected under 35 USC 103(a) as obvious over Collins in view of Schneider and further in view of Gorin (U.S. Patent No. 4,464,223). The Office Action alleges that Collins and Schneider teach all of limitations of the claims except for a DC voltage source being coupled to the conductive plate. The Examiner alleges that Gorin teaches a plasma processing apparatus wherein an electrode may be coupled to an RF power source, to a DC power source, or being grounded through a series circuit and that the use of the DC power supply allows the amount of DC biasing induced by the plasma to be changed independently of pressure or

power. The Examiner takes the position that it would have been obvious to implement the bias power mechanism including the DC power source as taught by Gorin et al in the apparatus of Collins et al in view of Schneider et al in order to control the amount of bias independently of pressure or power.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested by Collins or Gorin. Accordingly, it is respectfully submitted that Claim 15 would not have been obvious over Collins and Gorin, alone or in combination.

Rejection of Claim 12 - 14 and 16 - 18 under 35 U.S.C. §103(a) over Li in view of Collins and Schneider

Claims 12 - 14 and 16 - 18 were rejected under 35 USC 103(a) as obvious over Li et al (U.S. Patent No. 5,772,771) in view of Collins and Schneider. The Office Action alleges that Li teaches a plasma processing apparatus comprising a housing including a (truncated) dome surrounded by the coils and having its upper face covered by a top its bottom face sitting on a processing chamber side wall, a coil antenna for generating a plasma; a radio-frequency power source for supplying radio-frequency electric power to the antenna; a gas supply unit connected to a gas distribution nozzle for supplying a gas into the chamber; a substrate support for

supporting a substrate, and a bias radio frequency power source for applying a bias RF frequency to the wafer support; and an exhaust port disposed at the bottom of the chamber. The Examiner acknowledges that Li fails to teach a Faraday shield provided around the plasma generating portion. The Examiner alleges that Collins et al teaches a plasma processing apparatus including a Faraday shield in order to produce a plasma mainly inductively rather than capacitively. The Examiner alleges that it would have been obvious to employ the Faraday shield as taught by Collins et al in the apparatus of Li et al in order to generate a plasma mainly inductively. The Examiner acknowledges that Li and Collins fail to teach the Faraday shield being in floating position to a ground. The Examiner alleges that Schneider et al teach a Faraday shield element that can be grounded or left floating so that no ohmic voltage drop occurs in it while it is acting as a Faraday shield. The Examiner takes the position that it would have been obvious to implement the Faraday shield connection mechanism as taught by Schneider et al in the apparatus of Li et al in view of Collins et al in order to be able to leave the Faraday shield grounded or floating so that no ohmic voltage drop occurs in the shield when an RF is applied to the plasma generating inductive coil. Regarding claims 1, 17, 18, the Examiner refers to in re Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984) wherein it was held that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. The Examiner further alleges that Schneider et al teach a plasma reactor including a plasma generation

chamber having a conical dome extending from the side of the lower chamber to a position approximately over the edge of the pedestal, that the conical dome is arranged to have a larger rim at its bottom side towards the wafer processing area and a smaller rim at its top side away from the wafer processing area and that the conical configuration of the wall assures good thermal contact and eliminates the air gaps present in prior art design. The Examiner further alleges that the use of conical wall shape together with conically shaped induction coil windings reduces the variation in the electric field in the chamber (particularly at the center of the chamber), while the use of fixed and variable pitch coil windings can fin tune the effect of the desired electric field. The Examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the conical configuration as taught by Schneider et al in the apparatus of Collins et al in order to reduce the variation in the electric field in the chamber particularly at the center of the chamber. Regarding claim 13, 14, 16, the Examiner alleges that Collins et al further teach a plasma processing apparatus including a third electrode 17T disposed in the upper section 16A, that the third electrode may be floating, grounded or connected to an RF power source 40 as shown in Fig. 1, and that the third electrode may have various configuration and can be made of various material such as aluminum or silicon. The Examiner takes the position that it would have been obvious to implement the bias mechanism including the grounding as taught by Collins et al in the apparatus of Li et al in order to enhance various processing characteristic including etch rate and plasma coupling. Regarding claim 13, 14, 16, the Examiner alleges that the apparatus of Li et al further includes a top acting as an anode and is electrically biased by a second RF power source.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested in Li, Collins or Schneider. Accordingly, it is respectfully submitted that Claims 12 - 14 and 16 - 18 would not have been obvious over Li, Collins and Schneider alone or in combination.

Rejection of Claim 15 under 35 U.S.C. §103(a) over Li in view of Collins and Schneider and further in view of Gorin

Claim 15 was rejected under 35 USC 103(a) as obvious over Li in view of Collins and Schneider and further in view of Gorin. The Office Action alleges that Li in combination with Collins and Schneider teaches all limitations of the claims except for a DC voltage source is coupled to the conductive plate. The Examiner alleges that Gorin teaches a plasma processing apparatus wherein an electrode may be coupled to an RF power source, to a DC power source, or being grounded through a series circuit. The Examiner further alleges that use of the DC power supply allows the amount of DC biasing induced by the plasma to be changed independently of pressure or power and that grounding will change the electrode area ratio between a high frequency electrode and a ground electrode is changed. The Examiner takes the position that it would have been obvious to implement the bias power mechanism including the DC power source as taught by Gorin in the apparatus of

Collins and Schneider in order to control the amount of bias independently of pressure or power.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested by Li, Collins, Schneider or Gorin.

Accordingly, it is respectfully submitted that Claim 15 would not have been obvious over Li, Collins, Schneider and Gorin, alone or in combination.

Rejection of Claims 12 - 14 and 16 - 18 under 35 U.S.C. §103(a) over Lu in view of Collins and Schneider

Claims 12 - 14 and 16 - 18 are rejected under 35 USC 103(a) as obvious over Lu et al (U.S. Patent No. 5,904,778) in view of Collins and Schneider. The Office Action alleges that Lu et al teach a plasma processing apparatus comprising a plasma generating chamber defined by side wall and a top wall, wherein the housing comprising a truncated conical dome having an RF inductive coil wrapped around its outside, and a roof and a bottom side sitting on a processing chamber; a coil antenna for generating a plasma; a radio-frequency power source for supplying radio-frequency electric power to the antenna; a gas supply unit; a pedestal electrode for supporting a wafer, and a bias radio-frequency power source for

applying a bias RF frequency to the wafer support; and a vacuum pumping system. The Examiner acknowledges that Lu et al fail to teach a Faraday shield provided around the plasma generating portion. The Examiner alleges that Collins et al teach a plasma processing apparatus including a Faraday shield in order to produce a plasma mainly inductively rather than capacitively. The Examiner takes the position that it would have been obvious to employ the Faraday shield as taught by Collins et al in the apparatus of Lu et al in order to generate a plasma mainly inductively. The Examiner acknowledges that Lu et al in view of Collins et al fail to teach the Faraday shield being floating. The Examiner alleges that Schneider et al teach a Faraday shield element that can be grounded or left floating so that no ohmic voltage drop occurs in the shield while it is acting ad a Faraday shield. The Examiner takes the position that it would have been obvious to implement the Faraday shield connection mechanism as taught by Schneider et al in the apparatus of Lu et al in view of Collins et al in order to be able to leave the Faraday shield grounded or floating so that no ohmic voltage drop occurs in the shield when an RP is applied to the plasma generating inductive coil. Regarding claims 13, 14, 16, the Examiner alleges that Collins et al further teach a plasma processing apparatus including a third electrode disposed in the upper section, that the third electrode may be floating, grounded or connected to an RF power source and that the third electrode may have various configuration and can be made of various material such as aluminum or silicon. The Examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias mechanism including the bias RF power source as taught by Collins et al in the apparatus of Lu et al in order to enhance various processing characteristic including etch rate and selectivity.

Regarding claim 13, 14, 16, the Examiner alleges that the top wall is grounded. Further regarding claims 17 and 18, the Examiner refers to in re Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984) which holds that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested in Lu, Collins or Schneider. Accordingly, it is respectfully submitted that the Claims 12 - 14 and 16 - 18 would not have been obvious over Lu, Collins and Schneider, alone or in combination.

Rejection of Claim 15 under 35 U.S.C. §103(a) over Lu in view of Collins and Schneider and further in view of Gorin

Claim 15 was rejected under 35 USC 103(a) as obvious over Lu in view of Collins and further in view of Gorin. The Office Action alleges that Lu, Collins and Schneider teach all limitations of the claims as discussed above except for a DC

voltage source is coupled to the conductive plated. The Examiner alleges that Gorin teaches a plasma processing apparatus wherein an electrode may be coupled to an RF power source, to a DC power source, or being grounded through a series circuit. The Examiner alleges that use of the DC power supply allows the amount of DC biasing induced by the plasma to be changed independently of pressure or power and that grounding will change the electrode area ratio between a high frequency electrode (plasma source) and a ground electrode (return path) is changed. The Examiner takes the position that it would have been obvious to implement the bias power mechanism including the DC power source as taught by Gorin et al in the apparatus of Collins and Schneider in order to control the amount of bias independently of pressure or power.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested in Lu, Collins, Schneider or Gorin. Accordingly, it is respectfully submitted that Claim 15 would not have been obvious over Lu, Collins, Schneider and Gorin, alone or in combination.

Rejection of Claims 12, 17 and 18 under 35 U.S.C. §103(a) over Lu in view of Savas

Claims 12, 17 and 18 were rejected under 35 USC 103(a) as obvious over Lu

in view of Savas (U.S. Patent No. 5,811,022). The Office Action alleges that Lu et al teach a plasma processing apparatus comprising a plasma generating chamber defined by side wall and a top wall, wherein the housing comprising a truncated conical dome having an RF inductive coil wrapped around its outside, and a roof and a bottom side sitting on a processing chamber; a coil antenna for generating a plasma; a radio-frequency power source for supplying radio-frequency electric power to the antenna; a gas supply unit; a pedestal electrode for supporting a wafer, and a bias radio-frequency power source for applying a bias RF frequency to the wafer support; and a vacuum pumping system. The Examiner acknowledges that Lu et al fail to teach a Faraday shield provided around the plasma generating portion wherein the shield is a floating potential. The Examiner alleges that Savas et al teach a Faraday shield element disposed between an induction coil and a plasma generation chamber in order to reduce capacitive coupling between the antenna coil and the plasma, wherein the Faraday shield may be grounded through an adjustable impedance Zs. The Examiner takes the position that it would have been obvious to employ the Faraday shield as taught by Savas in the apparatus of Lu et al in order to reduce plasma coupling. Further regarding claims 17 and 18, the Examiner refers to in re Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984) which holds that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

This rejection is respectfully traversed as it may be applied to Claims 12-18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested in Lu or Savas. Accordingly, it is respectfully submitted that Claims 12, 17 and 18 would not have been obvious over Lu and Savas, alone or in combination.

Rejection of Claims 13, 14 and 16 under 35 U.S.C. §103(a) over Lu in view of Savas and further in view of Collins

Claims 13, 14 and 16 were rejected under 35 USC 103(a) as obvious over Lu in view of Savas and further in view of Collins. The Office Action alleges that Lu et al in view of Savas et al teach all limitations of the claims except for a plate made of a conductor or semiconductor and placed on an inner side of the upper face of the vacuum chamber. The Examiner alleges that Collins et al teach a plasma processing apparatus including a third electrode disposed in the upper section, that the third electrode may be floating, grounded or connected to an RF power sourceas shown in Fig. 1, and that the third electrode may have various configuration and can be made of various material such as aluminum or silicon. The Examiner takes the position that it would have been obvious to implement the bias mechanism including

the bias RF power source as taught by Collins et al in the apparatus of Lu et al in view of Savas et al in order to enhance various processing characteristic including etch rate and selectivity.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested in Lu, Savas or Collins. Accordingly, it is respectfully submitted that Claims 113, 14 and 16 would not have been obvious over Lu, Savas and Collins, alone or in combination.

Rejection of Claim 15 under 35 U.S.C. §103(a) over Lu in view of Savas and Collins and further in view of Gorin

Claim 15 was rejected under 35 USC 103(a) as obvious over Lu in view of Savas and Collins and further in view of Gorin. The Office Action alleges that Lu et al in view of Savas et al and Collins et al teach all limitations of the claims as discussed above except for a DC voltage source is coupled to the conductive plated. The Examiner alleges that Gorin teaches a plasma processing apparatus wherein an electrode may be coupled to an RF power source, to a DC power source, or being grounded through a series circuit, that use of the DC power supply allows the amount of DC biasing induced by the plasma to be changed independently of pressure or power and that grounding will change the electrode area ratio between a

high frequency electrode and a ground electrode is changed. The Examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the bias power mechanism including the DC power source as taught by Gorin et al in the apparatus of Lu et al in view of Savas and Collins et al in order to control the amount of bias independently of pressure or power.

This rejection is respectfully traversed as it may be applied to Claims 12 - 18 as amended herein. In particular, Claim 12 is amended to further define the structure of the coil antenna and the Faraday shield and their relationship. Specifically, as discussed above, Claim 12 is amended to require that the coil antenna is wound around the inclined side wall member and outside of the Faraday shield so that a direction in which the coil antenna is wound is perpendicular to a slit provided in the Faraday shield. This structure is neither disclosed nor suggested in Lu, Savas, Collins or Gorin. Accordingly, it is respectfully submitted that Claim 15 would not have been obvious over Lu, Collins, Savas and Gorin, alone or in combination.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that Claims 12 - 18 are in condition for allowance. Favorable reconsideration is respectfully requested.

Should the Examiner believe that anything further is necessary to place this application in condition for allowance, the Examiner is requested to contact applicants' undersigned attorney at the telephone number listed below.

Kindly charge any additional fees due, or credit overpayment of fees, to Deposit Account No. 01-2135 (520.35833VV5).

Respectfully submitted,
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